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Impact of quasi-symmetry on stellarator equilibrium, stability and transport[1] A.S. WARE, K. MCGARVEY-LECHABLE, University of Montana — Development of three-dimensional toroidal confinement devices with quasi-symmetry of the magnetic field strength in Boozer coordinates is a key component of the U.S. stellarator program. Previous work has led to the design of quasi-helically symmetric (QH), quasi-axisymmetric (QA) and quasi-poloidally symmetric (QP) stellarators but at very distinct aspect ratios, major radii, and plasma β. In this work, a computational analysis is undertaken to optimize stellarator configurations for a variety of quasi-symmetries, all at the same target aspect ratio, major radius and plasma β. We compare initial cases of QA, QP, and two QH configurations. The initial optimizations focused solely on enhancing quasi-symmetry. The QP configuration had high magnetic ripple which resulted in a relatively high ballooning stability β-limits and also relatively high estimates of ripple-induced neoclassical transport. The other three configurations had lower magnetic ripple and consequently lower ballooning stability β-limits and much lower estimates of ripple-induced neoclassical transport. Subsequent optimizations have focused on simultaneous optimization of degree of quasi-symmetry, higher β stability, and lowering ripple transport.

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